DOCUMENT RESUME

ED 154 330 CG 012 650

AUTHOR Mathison, Marjorie A.
TITLE Curricular Interventions and Programming Innovations for the Reduction of Mathematics Anxiety.
PUB DATE Aug 77
NOTE 9p.; Paper presented at the Annual Convention of the American Psychological Association (San Francisco, California, August 26-30, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Anxiety; College Students; Higher Education; Instructional Innovation; *Intervention; *Mathematics Curriculum; Program Descriptions; *Program Planning; *Psychoeducational Processes; Student Teacher Relationship
IDENTIFIERS *Mathematics Anxiety

ABSTRACT

Math anxiety, or mathophobia, is an irrational fear of mathematics which interferes with the manipulation of numbers. In mild forms it may be only an annoyance, but severe forms may result in total avoidance of numerical operations, with accompanying fears and stress. Three methods for dealing with math anxiety have been developed by various institutions across the country: remediation, content manipulation, and an integrated approach involving both math coursework and psychological intervention. Basic considerations in curricular interventions for math anxiety are: (1) population being served, including age and sex; (2) what institutional resources are available and how they can be structured; (3) faculty selection; and (4) sensitization of other math faculty within the institution. The third consideration is perhaps the most crucial, since faculty characteristics such as respect for students, clarity of explanation, and clear but flexible goals have been shown to have positive effects on student attitude. (Author/BP)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

- ED154330

# CURRICULAR INTERVENTIONS AND PROGRAMMING INNOVATIONS FOR THE REDUCTION OF MATHEMATICS ANXIETY

Marjorie A. Mathison
University of Minnesota

Paper Presented at the APA Symposium
San Francisco, August, 1977

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

M.A. Mathison

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

CG 012650

Math anxiety and mathophobia are two terms used to describe a widespread and recently recognized phenomenon, the irrational fear of mathematics. We see it all around us - in people who can't balance their checkbooks, who can't compute their income tax, who can't add numbers without using their fingers. Math anxiety is more than incompetence in math, however. It is a lack of math skills coupled with an attitude which interferes with the development or use of such skills.

Math anxiety is recognized as a significant problem because of the growing awareness of the importance of mathematics. Not only is math vital to daily transactions, it is a skill required for most occupations, especially those involving technical rigor and, hence, greater financial compensation. Math anxiety typically results in avoidance of math and math classes, severely limiting an individual's educational and occupational choices.

Lazarus has defined math anxiety as "an irrational fear of mathematics which interferes with the manipulation of numbers." In its milder forms, math anxiety may simply represent a discomfort associated with performing mathematical operations. In its more extreme forms, it may mean total avoidance of numerical operations or even blocking out numbers. Because of a characteristic avoidance of mathematics over time, those who are afflicted with math anxiety typically exhibit below-average ability in mathematics. This lower ability compounds the anxiety associated with mathematics, creating a spiraling effect. Anxiety leads to avoidance which leads to reduced ability which generates more anxiety. At some point this chain must be broken.

The Causes of Math Anxiety

Research conducted in the Math Anxiety Program at the University of Minnesota (Hendel, 1976) suggests several factors which interact to produce the phenomenon of math anxiety. The most common of these is past experiences with math education. Many participants were able to cite specific events in grade school or high school that were significant in their attitude formation. Most frequently these events involved negative experiences with math teachers, where teachers embarassed students or ignored the difficulties students were having.

> "I took it (math) two weeks - - close to tears through the hour every day. Then the teacher said, 'I know this has been a boring review for all of you - - now we can really get going.' I dropped the class."

> "I hated going to class. I was always afraid to ask a question because then all the attention focused on you. As a result I just got further behind until I convinced myself I couldn't do it an then covered that by it 'doesn't matter anyway' attitude."

Factors such as moving or illness frequently resulted in a student's falling behind and never catching up.

> "I was sick the week that fractions were covered. I never did learn how to divide them - it's been a mystery ever since."

Students lost at one point are likely to develop anxiety as they progress to higher levels of mathematics because math is by nature a progressive skill.

Men and women have traditionally received very different messages about the importance of mathematics. For adults in school twenty or thirty years ago these messages were particularly strong. Math was seen as a male domain and viewed as unimportant for girls in their future roles. The result was frequently that girls did not participate in math classes, and, as in most cases where knowledge is negligible,

felt uncomfortable - anxious - when they later found themselves in situations involving math. Men, expected to perform well in math, often find it difficult to admit to difficulties in math and to seek out the remedial help they need.

For most people, math carries its own mystique. It is viewed as a subject for the best and the brightest - beyond the skills of the average person. What most people fail to realize is that their approach to studying mathematics and their attitudes rather than their lack of inteiligence usually prevents them from grasping mathematical concepts.

Models for Dealing with Math Anxiety

Three ways have been developed for dealing with math anxiety by various institutions across the country:

(1) remediation
(2) content manipulation
(3) integrated approach: math coursework and psychological intervention

These models are effective under varying conditions.

Remediation is a useful tool in the treatment of math anxiety. Because of a long term avoidance of mathematics usually an individual identified as anxious about mathematics also lacks basic skills in mathematics. For some, simply learning what was never understood before eases the anxiety and makes it possible for the individual to move into other levels of mathematics. This method seems to be most useful where the student's anxiety is tied to a specific level of mathematics or where the student's anxiety level is relatively low.

Manipulation of course content, another approach in the treatment of math anxiety, is based on the philosophy that restructuring the material will make it more easily understood and will lessen anxiety. Examples of manipulation of course con-

tent include math labs, individualized instruction techniques, math games, discussion method of learning. Peer support and cooperation are often found to be effective techniques in anxiety reduction. Manipulation of course content, again, is perhaps most useful where the individual's anxiety is relatively low.

The third approach is an integrated approach which combines math coursework with psychological interventions. This approach is the most useful in dealing with a wide range of anxieties and levels of mathematics. The underlying theory of this approach is that mere remediation is insufficient; techniques must be learned that will help students transfer new attitudes toward "nonprotective" math situations. Math anxiety is dealt with on both affective and skills levels.

The Model At Minnesota

The Math Anxiety Program at the University of Minnesota uses an integrated approach to alleviate math anxiety. In its two years of existence over 500 people have participated in at least one phase of the program. The program was an outgrowth of a pilot project developed in January 1976 which was primarily remedial in nature. While beneficial, it became apparent that students needed to learn how to transfer their ability to do math outside of the classroom and that the class was not providing the necessary skills. After an extensive planning period involving six departments within the University, the Math Anxiety Program was developed.

The Math Anxiety Program has four components:

(1) Math Anxiety Diagnostic Clinic
(2) Math Classes
(3) Math Anxiety Support Group
(4) Math Tutorial

The Math Anxiety Diagnostic Clinic has four purposes: to help participants assess math skills and select an appropriate math course, to help participants assess the level and nature of their math anxiety, to provide a basis for the structured exper-

iences in the Support Group and to provide comparative data for post-testing for feedback to participants on the progress they had made and for program evaluation. The Clinic tests both the participant's math ability and level of math anxiety. The Math Anxiety Rating Scale (Richardson and Suinn, 1973) is the main instrument used to assess math anxiety. A Sentence Completion Questionnaire and Diagnostic Clinic Questionnaire supplement this information. A math ability test was developed which was self-scoring, thus reducing the fear of negative evaluation in the Clinic. A discussion of the problem of math anxiety and approaches for the study of math are presented by a math instructor. Following the Diagnostic Clinic participants have the option of enrolling in a math class, enrolling in a support group or both. Math classes offered through the program include Arithmetic and Elementary Algebra, Intermediate Algebra, Statistics, College Algebra and Financial Mathematics. Arithmetic and Elementary Algebra is a special course offered for noncredit. Upon completion students are notified of the number (maximum of 10) of credits and grade they may receive and make a decision at that point whether or not they wish to receive credit. The other courses all carry University credit. The instructors for these classes are chosen by their ability to relate to students, particularly students who have difficulty with mathematics. This is the singly most important aspect of the program. Students participating in the math classes also have access to free tutorial services.

The Math Anxiety Support Group is designed to help participants deal with their anxieties about mathematics. Activities in the support group include a mathematics autobiography, sentence completion questionnaire, a mathematics diary, weekly goal setting relevant to studying mathematics, discussion of math study skills, assertiveness to help students raise questions in class, relaxation exercises and mathematics games.

A pre-program and post-program comparison of MARS Scores (1977) revealed the most significant reduction in the level of math anxiety for those who participated in Diagnostic Clinic, Math Class and Support Group.

Basic Considerations in Curricular Intervention

The population being served is a prime consideration in the development of curricular interventions. Age and sex are two variables which will have great impact on program formation. At the elementary school level, little difference exists between boys and girls in the attitude toward and achievement in mathematics (Fennema, 1976). However, this is not true from high school on, where math is viewed as a predominantly male domain and where intervention must include encouragement of young women into math classes. By college, women have been severly handicapped by their lack of participation in math and for both men and women attitudes are more strongly defined. Interventions for adults have the added variable of distance from the study of math and greater diversity in the levels of math desired.

The second consideration in curricular intervention is what institutional resources are available and how these can be structured to adequately meet the needs of the target population. This refers to both the external structuring (credit/noncredit, mixed vs. single sex, level of math class) and the internal structuring in terms of instructional approach.

Faculty selection is perhaps the most crucial consideration, however. Aiken (1976) has found the instructor significantly more influential in development of attitudes towards mathematics than curriculum. A national study of high school students' best class/worst class (Cooper and Petrosky, 1976) supports this and identifies the faculty characteristics which have the most positive effect on student attitude. These include respect for students built on understanding and kindness,

clarity of explanation, attention to the learning problems of individual students and clear but flexible goals and direction for the course.

Finally, sensitization of other math faculty within the educational institution is extremely vital to the success of any curricular intervention. This includes sensitization to the problem of math anxiety as well as development of an understanding of the goals and directions of the program. Efforts should be made to tie the interventions as directly as possible to the overall curricula in math and math-related fields to ease the transition into regular classes and to decrease the likelihood that the student's new found confidence in math will be shaken.

## REFERENCES


Aiken, Lewis R., "Update on Attitudes and Other Variables in Learning Mathematics," Review of Educational Research, Spring, 1976, Vol. 46, No. 2, pp. 293-311.

Cooper, Charles R. and Anthony Petrosky, "Secondary School Students' Perceptions of Math Teachers and Math Classes," Math Teacher, March 1976, Vol. 69, pp. 226-233.

Fennema, Elizabeth, "Influences of Selected Cognitive, Affective and Educational Variables on Sex-related Differences in Mathematics Learning and Studying," National Institute of Education, Grant #P-76-0274, Oct. 1976.

Hendel, Darwin, THE MATH ANXIETY PROGRAM: IT'S GENESIS AND EVALUATION IN CONTINUING EDUCATION FOR WOMEN, University of Minnesota, Minneapolis, 1977.